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ABSTRACT

This paper describes the development process of multimedia software designed to educate and provide awareness of ecotourism in Costa Rica. Ecotourism is a form of nature-based travel and recreational experience combining a respect for nature and local cultures with economic development incentives. The software intends to pursue the goals of ecotourism by presenting an alternative method of traveling; it provides a sustainable and entertaining alternative to direct visits. Additionally, it offers training prior to departure by presenting background reference readings, videos, and "dos and don'ts" lists. Created during a hypermedia development course, the multimedia software, "Ecotourism on a Computer Screen: Ecotourism in Costa Rica," incorporates stills, graphics, videos and sound clips. The paper also details lessons experienced in the development of the software. Successful and unsuccessful techniques are described. Many of these procedures are repeatable, while several others should be avoided or implemented differently. In order to provide some useful hints for multimedia development both at the storyboard and programming levels, these alternatives are evaluated. Suggestions for facilitating a semester-long multimedia project are added. Future work includes developing a framework to test the effectiveness of multimedia software for ecotourism. Eight figures present sample screens. (Contains 16 references.) (Author/AEF)

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ED 422 934

DESIGNING MULTIMEDIA FOR ECOLOGICAL TOURISM IN AN EDUCATIONAL SETTING

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This paper describes the development process of multimedia software designed to educate and provide awareness of ecotourism in Costa Rica. Ecotourism is a form of nature-based travel and recreational experience combining a respect for nature and local cultures with economic development incentives. The software intends to pursue the goals of ecotourism by presenting an alternative method of traveling: it provides a sustainable and entertaining alternative to direct visits. Additionally, it offers training prior to departure by presenting background reference readings, videos and "do's and don'ts" lists. Created during a Hypermedia Development course, the multimedia software, "Ecotourism on a Computer Screen: Ecotourism in Costa Rica," incorporates stills, graphics, videos and sound clips. The paper also details lessons experienced in the development of the software. Successful and unsuccessful techniques are described. Many of these procedures faced in the class project are repeatable, while several others should be avoided or implemented differently. In order to provide some useful hints for multimedia development both at the storyboard and programming levels, these alternatives are evaluated. Suggestions for facilitating a semester-long multimedia project are added. Future work includes developing a framework to test the effectiveness of multimedia software for ecotourism.

INTRODUCTION

This paper describes the development of a multimedia application in a graduate course on hypermedia information systems. It is primarily intended to illustrate the lessons learned from the exercise and evaluate the feasibility of undertaking such a project in a one-semester class. Fostering environmental protection by using interactive media technology is the second purpose of the authors and the developers of the CD-ROM. Further research will include hypothesis-testing on users' acceptance of multimedia as a sustainable alternative to travelling. The paper refers to the class project, which is offered as an example of the outcome of an introductory hands-on multimedia course. The content of the CD and the reasons for its creation are also analyzed by focusing on the benefits that environmentally-oriented technologies can bring to the conservation cause.

COURSE REQUIREMENTS AND ORGANIZATION

The CD "Ecotourism on a computer screen: Ecotourism in Costa Rica" was developed in a graduate course in the School of Business School and Public Management of the George Washington University. "Hypermedia Information Systems" is simultaneously a business and a multimedia development course. This dual nature of the course requires looking at the development of the application from two perspectives: the business component and the programming level. Both aspects have different

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implications and require different levels of expertise. In this specific case, the combination of students in the Master of Business Administration program with students in the Master of Information Systems program brought together the synergy of efforts to fulfill the course requirements and structure. This combination of students is successful as it adds marketing skills to a technical focus. In this way, software development assumes the features of a project management exercise: it needs to satisfy shifting requirements, to test the prototype, to develop marketing ideas and to create a product that is potentially ready for the market. The final grade is based on both the technical aspects (use of different media) as well as the originality, usefulness and commerciability of the idea.

The theory of multimedia, the learning effects of media integration, the basic notions of effective graphical user interface design are not within the scope of the course. This introductory course does not require a theoretical analysis and focuses exclusively on hands-on development, video digitization, capturing, scanning, sound recording and similar. It remains practical with a blending of the business and programming perspectives.

The Business Aspect

The business component of the course focuses on applications that have a financial value and serve a commercial purpose. The CD "must virtually sell," thus finding its niche in a non-saturated market. Students are divided into groups of four with the task of transforming a business idea into a software application. The teams are in charge of "selling their idea" to the class as if it was a business venture. This implies submitting a business plan with detailed figures on costs and scheduling (time and resources). This plan is presented to the instructor who critiques the economics of the proposed project and the feasibility of completion in the semester span. A work-breakdown schedule (WBS) of the project is submitted for review. The final WBS benefits from the input of individuals other than the development team. Classmates react to presentations of the storyboards and are given additional material to critique.

The process of critiquing other projects is particularly useful for furthering peer learning. At this stage, students are testing their ideas in public and they can determine whether the latter are likely to capture a share of the market (figuratively represented by class consent and support). Following the review, adjustments can be made to meet the business requirements. It is therefore important that the financial aspects of the project are detailed with consistency. Also the feedback from the targeted market segment needs to be taken into account. Depending on the segment, a certain amount of resistance to the use of technology needs to be factored in. Class reactions can be the first step for testing the likelihood of having found "the" idea.

Instructors may push for review even beyond the class context. In several cases, students contacted the interested organizations and presented their project both for acquiring extra-information and for discovering possible interest in using the software. Groups dealing with video-rentals contacted Blockbuster; groups developing a CD on US National Park contacted the Natural History Museum; groups developing an interactive map for Washington DC contacted the Smithsonian Institution, etc. The Costa Rica group contacted the Caribbean Conservation Corporation (CCC) and other interested environmental organizations. This requirement forces investigation about possible placements of the application.

The Programming Aspect

There are a series of constraints needing consideration when determining the application. The complexity of the project must comply with the resources available for a semester-long course in terms of equipment, access to laboratories and time allocated for the assignment. The choice is usually between development of a prototype by making only selected icons accessible, or development of a complete application. Time is the primary factor for consideration. Can the whole software be developed in one semester? The answer varies according to:

1. Number of people in the team and their areas of expertise;
2. Access to University resources (scanner, video capturing, software, camcorder, digital camera and other facilities);
3. Access to information to be uploaded in the software.

These factors are examined by drawing on the experience of the team involved in the development of the ecotourism CD. In terms of the number of participants, a group of four people worked smoothly. Having fewer people might create problems in the gathering of information, but provides the advantage of consistency in the integration of the various components.

The software used for this CD development is Version 6.0 of Icon Author by Amtech Corporation. In Icon Author, individual pages (called smart pages) perform similar to Web pages. As long as common patterns are established beforehand to reduce the complexity of the integration (authoring) phase, the smart-pages can easily be developed separately. This implies close coordination and parallel work by participants, a procedure that does not function well with a large number of team members. Regarding the level of expertise, it is desirable that different skills are represented in the team. Programming skills are as crucial as artistic, organizational and business skills. The CD needs to be attractive. It also needs to be structured. The user should become interested in the content as well as be at ease in scrolling around different pages without a manual of explanations. The means for understanding the objective and structure of the CD, without the developers' help are provided. Good organizational skills are crucial for an efficient technical development scheme.

In terms of access to resources, the number of users needs to be carefully controlled. Scheduling hours for access to laboratories by individual teams works better and avoids waiting time. Ideally, laboratory sessions should be made available for each team. Not surprisingly, there is also an issue of privacy that runs throughout the development. As in real business applications, there is no disclosure of the actual product until it is finalized.

In terms of access to information, before deciding whether to produce a prototype, it is crucial to have a clear idea on types of text, video and audio to use. If new material needs to be produced, the amount of time for the development of the final application increases exponentially. The final choice depends on how much material is already available, how many pictures need to be scanned or how many videos need to be filmed and digitized.

Prototyping versus Complete Stand-alone Applications

The choice between prototype and complete application was an easy one for the team members. There was information, pictures, videos and sound clips available from the developers' tour to Tortuguero, a national park in northeast Costa Rica founded primarily for the protection and conservation of marine turtles' nesting habitat. Additionally, access to University resources was available during weekend. These factors created a favorable environment for developing a complete application that would be "burned" into a CD at the end of the semester. Is this the desirable choice for any other course of this type? Unlikely. No other group in the course developed a CD ready application. Realistically, prototyping is a wiser choice for a one-semester course. In this particular case, the drive to convey a message for environmental protection warranted the extra-hours of work required for the development.

THE ENVIRONMENTAL FOCUS

The title of the CD is "Ecotourism on a Computer Screen: Ecotourism in Costa Rica". The second part of the title explains the geographical focus: Costa Rica. The first part conveys a new concept: practicing ecologically sound tourism using a computer. This is a step beyond the promotion of ecological tourism (ecotourism) as a form of travel to natural areas. Ecotourism is already an obvious success-story in Costa Rica. This country provides several opportunities for participating in nature-based tours. The tours vary from bird watching to volcano climbing, from turtle-watching to river and ocean kayaking. Tourism in Costa Rica is the largest money earner in foreign exchange. The geographical and ecological positions of the country capture different segments of the tourism market. Costa Rica is much more than a beach destination with elegant resorts. Nature-based tourism is increasingly gaining popularity (due to the saturation of the traditional tourist industry and to differing travelers' needs). The travelers of the nineties share new motivations (desire of escape, respect for the environment, etc.) that nature-travel seems to better address. Nature travel includes a subset of activities:

1. *Scientific Tourism*, which involves researchers, scientists and students that are performing their tasks or studies in the field;
2. *Adventure Travel Tourism*, which includes rock-climbing, horse-riding and kayaking and represents the fastest growing segment of the market;
3. *Natural History Tours*, which can be divided in "soft tours" (outdoor experience without a specific topic interest) and "hard tours" (interest specific travel for birds observation or similar);
4. *Ecotourism*, in which travelers learn about the interrelationships between living organisms and different natural areas.

Using the Costa Rica CD, the idea is to propose another category of tourism, a technology-based one that uses multimedia to reach segments of the market that are omitted by traditional and nature-based tourism. It appears that categories of people that are physically challenged and cannot join the adventurous activities mentioned are not considered.

The Costa Rica CD was not designed for commercial purposes. The main objective for choosing the ecotourism project is that of rendering a service to the environment. It is also an attempt to decrease environmental depletion by resorting to information technologies and attracting tourists to eco-oriented travels.

The Intended Audience

As explained above, the objective is to offer an alternative to traditional tourism by reaching specific users. The intended users are:

1. people who have an interest in promoting environmental protection (non-profit organizations);
2. traditional tourist-channels (like tourist operators) that can help develop this interest;
3. people with disabilities not able to visit these places; and
4. all those who have concerns, such as time and money, that prevent travel to these areas.

How to target these users? One way is the production and distribution of nature-based multimedia applications. CD-ROMs can offer a surrogate experience by designing a "virtual itinerary" for tourists desiring to visit ecological destinations. There are very few CDs of this type in the market. Most of the applications available are commercial and are beautifully designed to promote visits rather than replace them. The reason for this promotion is that while mass-tourism is a danger for the environment, it brings economic resources that are used for local development. And, ecotourism has an important economic component added to it.

The Economic Component of Ecotourism

Ideally, the best way to protect endangered-areas and species is to ask people not to go to there. Human presence, nolens volens, ends up disrupting the environment. This is an ideal concept that finds very little applicability in practice. As nature tourism provides economic resources for the environment, the prevailing interest is to attract visitors to natural areas using revenues for funding local conservation programs and fueling economic development.

Considering the economic facet of ecotourism and the benefits that it brings to developing economies, it is difficult to gather a consensus that information technology, and in this specific case multimedia applications, should constitute a substitute to travel. Anybody who had the opportunity, time and money would prefer to spend a week in Tortuguero observing the Snapple turtle laying eggs, rather than reading about it on a magazine or watching it on a video. Trying to promote the latter alternative - instead of - direct experience would be like fighting against the windmills. Not only is there opposition by those desiring to travel, but also by people living on income generated by tourism. In the short-run, economic benefits are usually stronger arguments than any concern of damages to the environment.

The Objectives of the developers of the Costa Rica CD

There are three main objectives pursued by the developers: the first one is to raise awareness about the environmental damage caused by tourism; the second is to solicit donations for

conservation efforts; and the third is to provide alternatives means for travel for disables and children. The ideas presented in the Costa Rica CD do not imply that "virtual" is better than "real." They simply focus on some drawbacks of real experiences. Multimedia is here used as an instrument to **raise awareness** about the damage caused by interfering with turtles' nesting environments and practicing massive tourism in bio-diverse paradises. As an alternative to traditional tourism, the concept of ecotourism is explained and a training program for visiting Tortuguero is provided. Using the CD, users learn about the country in general, its economy, geography, political scenario and natural resources. Information on the Tortuguero reserve, environmental courses offered by the Caribbean Conservation Company (CCC) and videos on nesting turtles present scenery similar to the actual location. The training program helps the user gather information on behaving in eco-friendly locations (Do's and Don'ts are detailed). Examples of other eco-friendly locations (such as Manuel Antonio in Costa Rica and the eco-resort of Harmony in the Virgin Islands) complete the user's education about the meaning and the value of ecotourism. Additional information on lodging, shopping, eating and visa requirements are available to meet the needs of those eco-travelers that want to visit after having been instructed on ecologically sounds behaviors.

The reason for including information relating to traditional tourism is related to the second objective of the CD: to **raise donations** for promoting conservation efforts. Although the idea of lowering tourism might not be generally shared by tour operators, they want to be recognized as "friends of the environment". Tour operators may use the CD for training customers prior to departure, or even as an advertising tool. They may produce and sell the CD themselves, devoting a significant share of profits to the eco-location. Non-profit organizations working for environmental defense might sponsor the creation of similar CDs with reference to the Caribbean Conservation Corporation activities.

The last objective is to be comprehensive enough (still within the limit of a semester course) to provides opportunities for the disabled and children to **"virtually visit"** these locations. Sometimes this aspect is neglected by industry; multimedia may represent the only opportunity that physically challenged users have to learn about these remote destinations. Interactive multimedia, in its ability to combine text, sound, graphics and video can be the closest and a more complete substitute to direct visits. Associations for people with disabilities may be willing to sponsor the production of these types of CDs or at least to offer donations that support conservation efforts.

Because developing multimedia applications is increasingly expensive, it is important to focus on the monetary aspect of an eco-based multimedia application. In the class context, described later, most of the resources were available in the University and information could be accessed at no-additional cost. Should the idea of virtual travel to endangered areas be realized for commercial purposes (even if related to fund-raising for the environment), the production would require substantial investments.

THE DEVELOPMENT OF THE COSTA RICA CD

The Steps of Development of the CD

Creation of the storyboard and class review of the proposed project preceed implementation. Then, the actual designing begins. This entails creating a basic page with elements needing to be replicated consistently within the CD. In this case, the turtle-like navigation icons include the same colors for each topic and always change color when the link is selected. The different colors remind the user's location on the CD and enable movement to other pages.

After a standard initial format is established and common icons are copied to shared-files, the other pages can be developed separately. Team members collect pictures, graphics, digitized clips and sounds, and insert them into sub-menus. Each team member was in charge of an individual sub-project:

I. Costa Rica
II. Ecotourism
III. Flora and Fauna
IV. Eco-training Program
V. Travelers' information
VI. Eco-memories
VII. About the Caribbean Conservation Corporation (CCC)

The individual smart pages need to be integrated into a single authored program running the application and the loops. This task is performed jointly and changes to the structure of the pages are implemented simultaneously during the testing of the application. Finally, once the application is completed it needs to be burned onto a CD. These steps are presented in more details, each with a set of "success and failure stories."

Phase 1. Storyboard development by Team

The storyboard is one of the most critical stages of the development. It defines the structure and the content of the application. It needs to convey information on the topic, the format, and the scheduling of the project. Ideally it provides a pictured framework for the application. Using presentation software (MS PowerPoint 97, Corel Presentations) integrating sounds and videos is the easiest way to pre-view final software application.

Unsuccessful Technique. In the Costa Rica CD, however, the presentation software was not particularly representative. The CD is developed in several different pages that are connected by selectable buttons, hyperlinks for going back and forward from one page to another. A better way for presenting multimedia applications with these characteristics would be to use an HTML format to show movement as well as to include sound-clips. This task can be accomplished relatively easily, with Web publishing software currently available in the market.

Successful Technique. The choice of a topic with environmental focus gathered consent and support on the part of the class audience, witnessing the rising need for such an application and a possible agreement on the idea of exploring ways information technology can help the environment.

Phase 2. Creation of the First Page by Team (Figure 1)

The first page of the software is one requiring the user to input commands. It is preceded by a title page including sounds, pictures, animation, developers' names and leading automatically to the first interactive page. If animation in the title page is running, the user cannot interact or quit the program until the first page is reached. On this page, the user makes a choice on "where else to go." He needs to understand the structure very clearly. The first page becomes the access card and needs to be particularly self-explanatory, even more than the other pages.

Unsuccessful Technique. The interactive icons that lead to internal pages are not numbered. Ideally, the display is on a vertical line and the user will be prompted to start from the first element on the line. This is not necessarily the case, though. The user can decide to start following the topic that appeals him the most thus finding himself confused about the sequence of events. Numbered buttons would alleviate the confusion.

Successful Technique. The Costa Rica's first page includes a short speech explaining the purpose of the CD, the environmental concern for Costa Rica and the sea-marine turtles. On this page there are the selectable icons leading to the other sections of the CD. Additionally, each icon contains a pop-up menu which displays the different topics represented by the icon. By moving the mouse over any of the turtle-like buttons, the user understands the structure of the section and is prompted to select an icon representing a topic of interest.

Phase 3. Creation of pages by topic area by team members separately

This phase varies according to the choices made by individual developers.

Unsuccessful Technique. Most of the pages contain embedded pictures and photographs as background images. The picture is desktop-sized and, therefore, the .gif file is large. This creates a problem when displaying the application with different computers. With a fast pentium CPU, the delay in displaying the next page is minimal. This delay becomes larger when dealing with less sophisticated technology. A blank transition page appears for intervals that vary from 2-10 seconds, depending on the refresh time of the equipment used. A way for partially solving the problem is linking the graphic files to the smart pages. However, this option is not optimal, as linking requires that files be placed in the same location. In a class and laboratory context, it is very unlikely that the same computer is accessed

every time. The files usually need to be copied onto zip-drives or uploaded to Unix accounts. The latter process can become increasingly complex if each file needs to be constantly placed in the same directory. Although it is not optimal, in terms of delay in the display, embedding is preferred solution when dealing with different directory structures and equipment.

Successful Technique. The pages were developed separately, thereby adding dynamism and variety to the software. The changing background colors, artistic structure, informative content and special effects of new displays capture the attention of the user.

After the completion of smart pages, the description of each topic page needs to be developed separately. The following overview offers a more detailed description of the software and its goals translated into interactive objects.

Topic I. Costa Rica (Figure 2)

This page is an introduction to the country, containing information about geography, climate, economy, socio-political system and natural resources. The information is displayed with text, a short video on Costa Rica and a sound clip on the national anthem. Except for the page on the geography that is linked to a full-sized screen map of the country, this sub-topic is developed on a single page. Text and pictures change on button clicks, maintaining the same spatial position in the page.

Unsuccessful Technique. This page contains video and graphics whose uploading causes an evident delay in the running of the software.

Successful Technique. This page provides a complete introduction to essential information on the country.

Topic II. Ecotourism (Figure 3)

This smart page contains an overview on the concept of ecotourism, its growth patterns, its goals, the tourist population targeted and examples of eco-spots in Costa Rica. The background page is static and the videos, text and pictures vary at the click of the buttons.

The pros and cons are similar to the considerations for the previous page.

FIGURE 1

FIRST PAGE

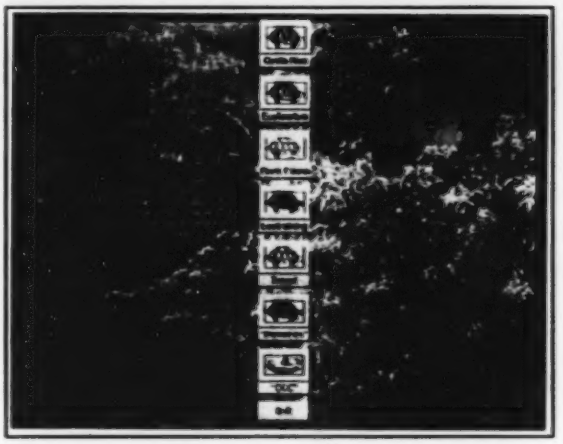
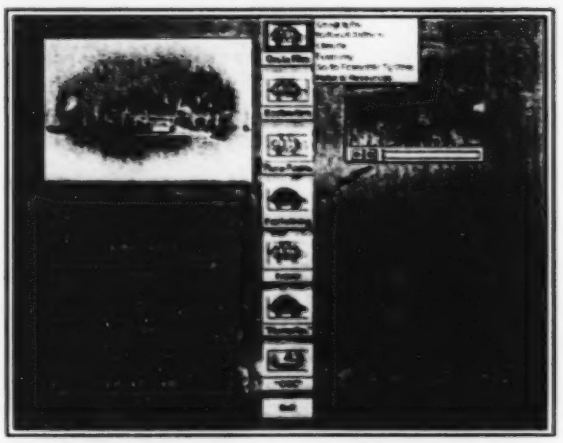


FIGURE 2

COSTA RICA



Topic III. Flora and Fauna (Figure 4)

This topic displays a graphical overview of the endangered species in Costa Rica. It contains a slide show of pictures and photos changing to the rhythm of superimposed music. A subset of pages with examples of endangered species, which includes sound clips, text, video and graphics, can be reached from this page.

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Unsuccessful Technique. Moving from one category to the other (from mammals to insects, to birds, to amphibians, etc.) requires returning to the original page that displays the slide-show.

FIGURE 3

ECOTOURISM

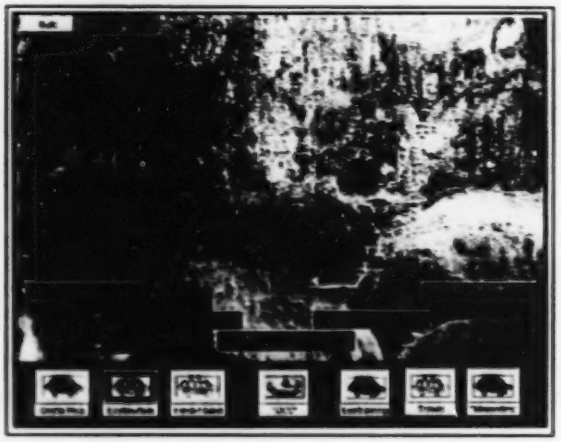
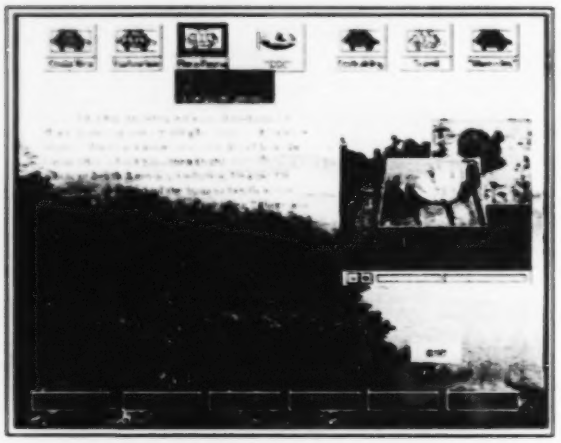


FIGURE 4

FLORA AND FAUNA



Successful Technique. This topic provides an excellent instrument for introducing users to the natural environment of Costa Rica. This fulfils one of the main objectives of ecotourism: favoring the exploration of the natural habitat by hearing sounds, watching the animals or flowers and "feeling there."

Topic IV. Ecotraining (Figure 5)

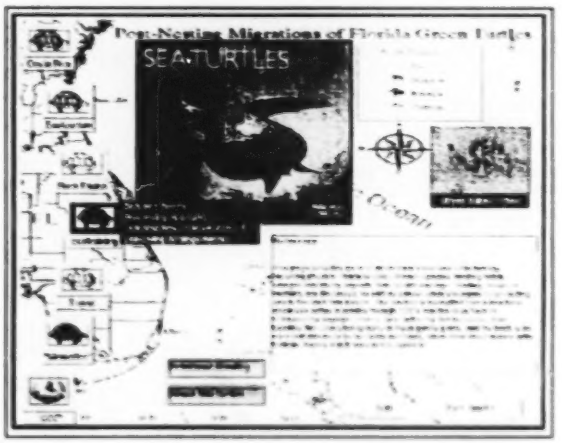
By suggesting reference reading and showing a video on turtles laying the eggs, this page introduces the topic of sea-marine turtles. It provides links to Do's and Don'ts that need to be followed by eco-travelers (prior to departure, during the trip and after returning home) and offers information about courses on sea-turtle nesting offered in Tortuguero. It also details what to expect when visiting Tortuguero and what to bring during the visit. Lastly, it offers examples of ecologically oriented resorts both in Costa Rica and in other Caribbean spots.

Unsuccessful Technique. This topic is developed in several different pages and the user is forced to scroll back through each of them to return to the original menu. A better structure should have allowed the user to move to other topics from each page.

Successful Technique. This is a complete overview that strictly mirrors the experience of turtle-watching. The clarity of the video and details is even more informative than what is able to be seen on the Tortuguero shore. The use of hotwords in the Do's and Don'ts section allows the developer to superimpose extra-graphics over the same background.

FIGURE 5

ECOTRAINING



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Topic V. Travel (Figure 6)

This section provides information about entry requirements, car rentals and accommodations, banking and currency, shopping and restaurants. This information is useful for tourists already deciding to travel.

Unsuccessful Technique. The use of fonts and colors is not appropriate. The selection of large fonts is more appropriate for presentations rather than on-screen reading.

Successful Technique. The amount of information and the use of blinking images add dynamism to the page.

FIGURE 6

TRAVEL

Topic VI. Eco-memories (Figure 7)

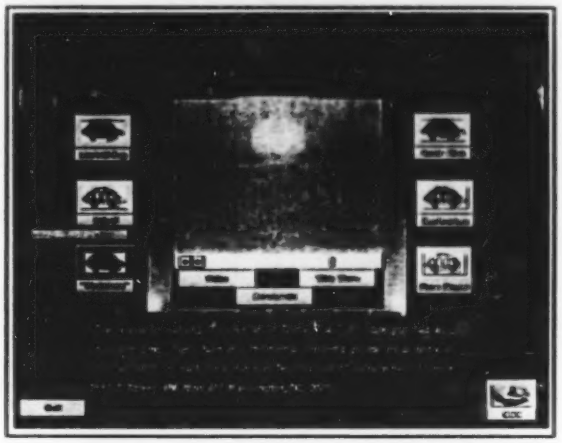
This page is a photo-album for the user, an ex-post experience with a collection of images of the adventurous trip. Since the developers of the CD are trying to reproduce "real travel" with "virtual format," the photo-show creates another successful simulation element. It produces settings similar to a movie theater.

Unsuccessful Technique. The photo-show file runs very fast without pausing to enjoy the beauty of the scenery, as it would be desirable in the real situation.

Successful Technique. The settings bring back memories and pictures that give the impression of having been there and being one's own set of memories.

FIGURE 7

ECO-MEMORIES



Topic VII. CCC (Figure 8)

This is an introduction to the role of the Caribbean Conservation Corporation and its efforts on sea-turtle protection. The national park of Tortuguero and its environment is described, with additional information on ecological activities.

Unsuccessful Technique. This topic can be seen as the last or the first in the list, depending on how the users decide to scroll the software. A better approach would have been one of opening the CD with an overview of the CCC activities therefore focusing on the objectives of the CD.

Successful Technique. Assigning CCC its own separate place, independent to other topics gives a stand alone value to each topic and opens the possibility of using the CD for exploring different elements. If the user is not interested in sea-turtle protection, he can still use the software as a good representation of the beauty of a place interesting to visit.

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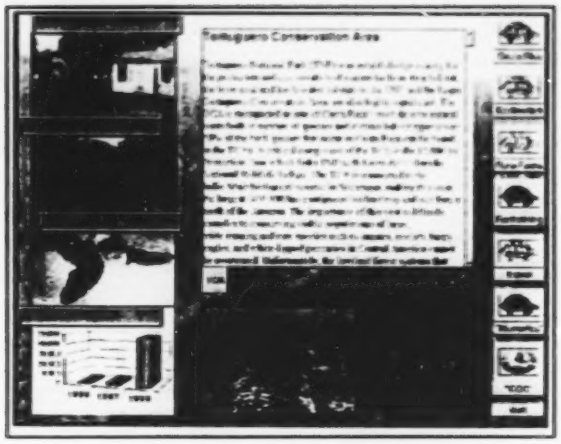
FIGURE 8

CCC



Phase 4. Integration in a single program (authoring) by team

This phase is the stage in which completed smart pages are put together. Programming is needed to integrate the sections through the links established in the individual objects.

Unsuccessful Technique. Some objects in the smart pages needed to be eliminated, as the program could not run the animation. Earlier testing would have saved the time used for the development of the discarded animation.

Successful Technique. After integration, quality and content control can be completed. Redundant information was removed.

Phase 5. Testing and correction of final program by team

Testing was conducted on several computers around campus. Initially, testing was limited to computers available in the multimedia laboratory.

Unsuccessful Technique. In the testing stage, several bugs were revealed, starting with the inability to display the videos. Some computers did not interpret the same video conversion format used in the digitization. Prior testing on computers different from the ones used for development would have detected the problem earlier. Each video file needed to be re-saved in generic format, compatible with standard installations. The quality of the original videos was substantially reduced. In addition, it was revealed that font size and appearance varied with the computer resolution. The application was designed for 800 X 600 resolution and major changes in each page where required. As time did not allow for extensive changes, a note on the CD case warns users about optimal hardware requirements.

The important lesson learned is that development needs to be conducted in lower resolutions throughout the project or, at least, it needs to be carefully tested on different hardware platforms during the project. The same applies when files need to be embedded, as size affects the uploading time.

Successful Technique. This phase gives real understanding and feedback about successful techniques. It is crucial that testing is conducted throughout the development in other facilities than the regular multimedia laboratory.

Phase 6. CD-recording by team

After the software is tested, CD-recording (burning) can be the easiest step as well as the most complicated. Mistakes can definitely be made at this stage, particularly by incorrect copying of the directory structure. Realistically, few CDs are lost in the process. Unless a re-writable CD is used there is room for faults. It is crucial that all the files used in the development are copied onto the CD for it to run successfully.

Lessons Learned in the Process

To recapitulate the lessons learned in the development, it can be stressed that the most crucial need in multimedia creation is to test the application on different platforms. Testing with lower quality equipment becomes crucial. Testing needs to be undertaken during the development as well as at the end. Early testing allows solving problems as soon as they appear. It also indicates how feasible is to implement abstract ideas into a programming language. Often times, the best idea is not easily translated into code.

Another lesson is that multimedia development in the classroom is best carried on in teams

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assigned different tasks for gathering data and sound, video and graphic files. In order to integrate the project once the individual objects have been completed, these teams need to follow pre-agreed guidelines.

There are still a series of bugs that could not be fixed before the end of the semester. The main concern was producing a final product that could be stand-alone and that could be shown to multimedia developers and environmental experts not just as a finished application, but as a representation of an idea that can help the environment.

Multimedia can NOT be a substitute to direct experience. However, it can be a useful training program for tourists deciding to get in contact with the environment: they need to learn how they are expected to behave and what are the Do's and Don'ts of their ecological experience. Multimedia can definitely be close substitute to direct visits for those that are not able to practice ecotourism because of physical constraints. Taking all this into account, the virtual experience becomes desirable.

FURTHER RESEARCH

One interesting aspect of this application the writers intend to explore is the impact of this product on general users. Do their attitudes toward environmental protection change after being exposed to the program? Do they see the benefits of virtual- travelling? Would they change their itinerary on the basis of the message they received from the CD? Would they, at least, consider an adjustment to their travelling style to include attention to recycling and respect for the flora and fauna? If yes is the answer to one or two of the questions above, this is already a step in the right direction. These and similar questions will be posed to full-time MBA students taking information systems courses. An on-line survey will be administered to these students before and after the use of the CD. Results will be analyzed in a hypothesis-testing framework and will include statistical analysis of data.

There will be several factors and biases that will need to be taken into account in the evaluation (i.e. the sample surveyed is not random). Controlling for these factors and recognizing their effects will be crucial. However, if statistical significance is found, it is hoped that the analysis can constitute a step forward in creating professional applications that will be more environmentally oriented than traditional tourist applications. The greater benefits for the environment will ultimately benefit the whole population.

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